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PETER ERZBERGER

Contribution to the bryophyte flora of Chalkidiki, Greece

Abstract

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As the result of a collecting trip to the peninsula of Chalkidiki in NE Greece in autumn 2002, 169 bryophyte taxa were recognized. Three of these, *Ephemerum serratum, Riccia beyrichiana* and *Thuidium delicatulum,* are new records for Greece, six are new records for mainland Greece, 23 for NE Greece and 19 for Chalkidiki. The high percentage of new records (31 %) demonstrates the poor state of the bryological exploration of Greece. An annotated catalogue of the collected taxa is presented, including notes on substrates and associated bryophytes.

Key words: *Musci, Hepaticae,* Mediterranean region, biodiversity, floristic inventory.

Introduction

The knowledge of the bryophyte flora of Greece is still insufficient (Hodgetts 1995), although a number of checklists (Preston 1981, 1984a-b, Düll 1995a) and contributions with new records (Blockeel 1991, 2001, Blockeel & al. 2002, Carratello & Aleffi 1998, Gallego & Cano 1998, Lüth 2002, Papp 1998, Papp & al. 1998a-b) have been published in the recent past. The peninsula of Chalkidiki is among the least thoroughly explored regions, in spite of the contributions by Düll (1995b) and Sauer (1995). This study presents results from a collecting trip made by the author in autumn 2002.

The Chalkidiki peninsula is situated in NE Greece, in the region of Central Macedonia. It consists of a northern, more continental part with the district capital Polygyros, the Cholomondas Mts (1163 m) and the Stratoniko Mts (820 m), and three narrow extensions in southern direction, formerly islands, but connected to the continent by sands in recent geological times (Düll 1995b). Their names are Kassandra, Sithonia and Athos (from west to east). Kassandra is covered by Neogene deposits (Jacobshagen 1986) and rather flat, with a highest elevation of 353 m. Its hills are covered by *Pinus halepensis* forest or cultivated land. Sithonia is composed of crystalline rocks, which are often denudated by erosion. According to its geological structure, it is part of the Circum-Rhodope-Zone. Sithonia-granodiorite (50 million years) and mesozoic ophioliths are exposed; these latter also occur in the south of Kassandra (Jacobshagen 1986). The highest elevation of Sithonia is 808 m. Its vegetation consists of *Pinus halepensis* forest and

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Mediterranean maquis, frequently dominated by *Erica* shrubs. The eastern peninsula of Athos was not visited, since it is under the administration of the monks' republic of Agion Oros and access permission is not easily obtained.

The northern part of Chalkidiki belongs to the Serbian-Macedonian Massif of crystalline rock, with mesozoic crystalline schists and granodiorite, porphyritic and granitoid formations (Jacobshagen 1986). Locally some calcareous deposits occur, that are mined in one place east of Paleokastro, and in the western part there is also sandstone and flysch (Kockel & al. 1972). The vegetation in the higher parts consists mainly of deciduous forest.

The climate is typically Mediterranean, with dry summers and most precipitation during winter. Mean annual temperature is about 15.9 °C, mean annual precipitation is 500-700 mm (Düll 1995b).

Material and methods

The specimens are kept in the herbarium Berlin-Dahlem (B). All investigated localities are situated in the Nomos Chalkidiki. The 25 collection sites are as follows:

1. 4.10., 16.10. 2002 – Kassandra, Siviri, 40°01.1'N, 23°21.8'E, 5-50 m, steep slope with *Pinus halepensis* forest north of the beach; *Prunus persica* at path to Oikismos Akrotiri.
2. 5.10.2002 – Kassandra, Kassandria, 40°03.0'N, 23°24.9'E, 50-100 m, old wall in village.
3. 5.10.2002 – Kassandra, Afitos, 40°06.0'N, 23°26.2'E, 50-100 m, well at steep slope above beach.
4. 5.10.2002 – Kassandra, Mola Kaliva, 39°58.3'N, 23°27.6'E, 50-100 m, south coast, steep slope at path leading to the hills.
5. 5.10.2002 – Kassandra, hills between Nea Skioni and Chaniotis, 39°58.6'N, 23°33.4'E, c. 300 m, *Pinus halepensis* forest, *Erica* scrub.
6. 7.10.2002 – Cholomondas Mts, east of Paleokastro, 40°25.3'N, 23°27.9'E, c. 700 m, deciduous forest, limestone outcrops.
7. 7.10.2002 – Cholomondas Mts, east of Paleokastro, 40°25.2'N, 23°28.4'E, c. 700 m, rocks at road east of stone industry.
8. 7.10.2002 – Cholomondas Mts, east of Paleokastro, 40°25.3'N, 23°28.9'E, c. 800 m, siliceous rock outcrops in deciduous forest.
9. 7.10.2002 – Cholomondas Mts, between Taxiarchis and Arnea, 40°26.3'N, 23°30.7'E, c. 900 m, deciduous forest, rocks at road.
10. 8.10.2002 – Cholomondas Mts, old, partly abandoned road between Polygyros and Paleokastro, 40°23.7'N, 23°25.6'E, c. 600 m, deciduous forest mixed with *Pinus,* creek, siliceous rock outcrops.
11. 8.10.2002 – Cholomondas Mts, between Taxiarchis and Arnea, 40°27.5'N, 23°31.4'E, c. 1000 m, deciduous forest, great siliceous rocks at road.
12. 9.10.2002 – Sithonia, hills east of Neos Marmaras, above Parthenonas, 40°07.7'N, 23°49.1'E, c. 400 m, two creeks, slopes, *Erica* scrub.
13. 11.10.2002 – Sithonia, hills east of Neos Marmaras, above Parthenonas, 40°07.2'N, 23°50.2'E, 500-600 m, creek, slopes, *Erica* scrub, path leading to top of Prophitis Ilias.
14. 12.10.2002 – Sithonia, near the southwest coast between Porto Koufos and Toroni, 39°50.2'N, 23°55.5'E, c. 200 m, *Erica* scrub.
15. 12.10.2002 – Sithonia, near the west coast near Ag. Pavlos, 40°08.5'N, 23°45.2'E, 150-200 m, *Erica* scrub.
16. 13.10.2002 – Stratoniko Mts, north of Neochori, forest edge at road to Varvara, 40°31.4'N, 23°41.0'E, c. 600 m, oak and beech forest.
17. 13.10.2002 – Stratoniko Mts, south of Varvara, 40°34.0'N, 23°39.5'E, 550-600 m, creek with *Fagus* and *Carpinus* trees.
18. 13.10.2002 – coastal plain, east coast, south of Olympiada, 40°33.5'N, 23°49.4'E, 50-100 m, creek.

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19. 13.10.2002 – coastal plain, hills at southeast coast, west of Ierissos, between Gomati and Ag. Ioannis Prodromos, 40°23.0'N, 23°42.3'E, 200-250 m, creek.
20. 14.10.2002 – Sithonia, east coast between Ormos Panagias and Kounia, 40°12.3'N, 23°45.9'E, c. 100 m, *Erica* scrub.
21. 14.10.2002 – Sithonia, east coast, creeks at road in hills west of Vourvourou, 40°10.9'N, 23°46.8'E, c. 200 m, *Platanus orientalis* trees, *Erica* scrub.
22. 14.10.2002 – Sithonia, east coast, creek flowing into Koutloumousi beach, 40°09.5'N, 23°53.4'E, c. 150 m, *Platanus orientalis* trees.
23. 14.10.2002 – Sithonia, east coast, path near road south of Sarti, 40°05.2'N, 23°58.3'E, c. 100 m, *Erica* scrub.
24. 15.10.2002 – Sithonia, east coast, Karidi beach east of Vourvourou, 40°11.6'N, 23°48.5'E, 0-10 m.
25. 15.10.2002 – Sithonia, hills in the south of the peninsula, Sikia, creek, 40°02.8'N, 23°55.9'E, c. 200 m, *Erica* scrub.

Nomenclature of liverworts and hornworts follows Grolle & Long (2000) and Söderström & al. (2002); nomenclature of mosses follows Corley & al. (1981) and Corley & Crundwell (1991) with amendments according to recent publications, e.g., Koperski & al. (2000), Hodgetts (2001) and Kucera & Holyoak (2005).

The floristic data are evaluated by comparison with published records in the literature: Podpera (1922), Ganiatsas (1937), Taylor (1952), Geissler (1977), Gamisans & Hébrard (1980), Preston (1981, 1984a-b), Jovet-Ast (1986), Düll (1995a-b), Sauer (1995), Blom (1996), Blockeel & al. (2002) and Söderström & al. (2002).

Results and discussion

A total of 169 bryophyte taxa were recognized. Among them, three are apparently new to the bryophyte flora of Greece: *Ephemerum serratum, Riccia beyrichiana* and *Thuidium delicatulum.* The following six taxa are evidently new to mainland Greece since previous reports refer to islands only: *Hedwigia ciliata* var. *leucophaea, Lophozia bicrenata, Pohlia annotina, Riccia* cf. *bifurca, R. canaliculata, Weissia* cf. *longifolia.* Another 23 taxa appear to be new to NE Greece as defined by Preston (1984b), i.e. east of Axios (Vardar) river, and 21 taxa are new to the peninsula of Chalkidiki, resulting in a total of 53 new national or regional records.

The relatively high percentage of new records demonstrates the incomplete geographical exploration of the bryophytes of Greece. This is no doubt caused by the scarcity of resident bryologists, so that most records come from foreign bryologists on holiday (Hodgetts 1995).

The new records also indicate that little is known of species with seasonal or ephemeral appearance and of special habitats. Fortunately the first autumn rains had fallen before the time of the collection trip in October 2002 and had enabled the development of a rich vegetation of soil-inhabiting thallose liverworts such as *Oxymitra incrassata, Riccia ciliifera, R. crinita, R. macrocarpa, R. nigrella, R. papillosa* and the associated moss *Ephemerum serratum*. Similarly, the bryophyte vegetation on freshly deposited alluvia near and in creeks, harbouring species such as *Entosthodon attenuatus* together with *Fossombronia* sp., *Lunularia cruciata, Epipterygium tozeri* and others, was well developed.

Some of the frequently encountered taxa that represent new records belong to species complexes with a recently amended taxonomy, e.g., the *Hedwigia ciliata* complex (Hedenäs 1994, Erzberger 1996) and the *Grimmia trichophylla* complex (Maier 2002). This explains why insufficient attention has been paid by earlier workers to the occurrence of taxa such as *Hedwigia ciliata* var. *leucophaea, H. stellata, Grimmia lisae* and *G. meridionalis,* which were found in most of the suitable siliceous rock surfaces. The boulders in Sithonia and rock outcrops in deciduous forests of the Cholomondas Mts were especially rich in populations of these mosses.

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The peninsula of Sithonia was studied with the greatest intensity, and this is reflected by the high number of 100 taxa found. The two main types of habitat studied here, *Erica* scrub and creek valleys, seem to harbour an especially rich bryoflora.

Two of the recorded species are listed in the Red Data Book of European Bryophytes (Schumacker & Martigny 1995): *Campylopus oerstedianus,* which is considered a rare species in Europe (R), and *Marchantia paleacea,* which is an insufficiently known species (K).

Last but not least, the record of a bryoparasitic fungus growing on *Campylopus oerstedianus, Lamprospora campylopodis* W. D. Buckley *(Pezizales),* kindly determined by D. Benkert, Berlin, should be mentioned. Knowledge on the distribution of this group of organisms is still scarce (Benkert 1987), and therefore the opportunity is taken here to draw the attention of bryologists to this interesting field of study.

Catalogue of bryophyte taxa collected

The taxa are listed in alphabetical order. Numbers in brackets following the number of the locality are the author's collection numbers. The following symbols and abbreviations apply:

** = taxa new to Greece
* = taxa new to mainland Greece
++ = taxa new to NE Greece as defined by Preston (1984b)
+ = taxa new to Chalkidiki
c. per. = with perianths; c. set. = with setae; c. spg. = with sporogones
det. = determinavit, named by; s. str. = sensu stricto; confirm. = teste, confirmed by.

Aloina aloides (Schultz) Kindb. – 4 *(8680);* base-rich conglomerate.
+*Aloina rigida* (Hedw.) Limpr. – 7 *(8723),* 10 *(8763);* humid, calcareous rock, soil; with *Gyroweisia tenuis.*
Amblystegium serpens (Hedw.) Schimp. – 10 *(8758);* base-rich rock.
Anomodon viticulosus (Hedw.) Hook. & Taylor – 17 *(8917);* tree roots near creek.
Atrichum angustatum (Brid.) Bruch & Schimp. – 13 *(8872);* soil in *Erica* scrub near creek.
Atrichum undulatum (Hedw.) P. Beauv. – 17 (obs.); on soil near creek.
Barbula convoluta Hedw. – 6 *(8708);* calcareous soil.
Barbula unguiculata Hedw. – 1 *(8672),* 4 *(8680),* 5 *(8691, 8696),* 6 *(8708),* 25 *(9002);* soil.
Bartramia pomiformis Hedw. – 13 *(8874),* 18 *(8929),* 19 *(8941),* 21 *(8961)* often c. spg.; soil.
Bartramia stricta Brid. – 15 *(8901);* soil.
+*Brachythecium populeum* (Hedw.) Schimp. – 17 *(8925);* siliceous rock.
Brachythecium rivulare Schimp. – 12 *(8803);* siliceous stone in shallow, flowing water of creek.
Brachythecium velutinum (Hedw.) Schimp. – 10 *(8760),* 16 *(8910);* soil, bark.
+*Bryoerythrophyllum recurvirostrum* (Hedw.) P. C. Chen – 9 *(8742);* base-rich soil.
+*Bryum argenteum* Hedw. – 6 *(8714),* 9, 10 *(8765),* 16; soil.
Bryum capillare Hedw. – 1 *(8664),* 9, 12 *(8793),* 15 *(8901),* 16, 18, 19 *(8943),* 22 (obs.); soil.
Bryum moravicum Podp. – 1 *(9007); Prunus persica* trunk.
Bryum pseudotriquetrum (Hedw.) P. Gaertn., B. Mey. & Scherb. – 10 *(8766),* 12 *(8805, 8838),* 13 *(8862, 8863, 8877);* soil near water.
+*Calliergonella cuspidata* (Hedw.) Loeske – 12 *(8805);* humid soil.
++*Calypogeia fissa* (L.) Raddi – 12 *(8800),* 13 *(8861);* soil.
Campylium calcareum Crundw. & Nyholm – 7 *(8721),* 17 *(8914);* shaded calcareous rock, soil.
+*Campylium chrysophyllum* (Brid.) Lange – 10 *(8766);* soil.
Campylopus oerstedianus (Müll. Hal.) Mitt. – 13 *(8846a, 8847);* soil. – Considered rare according to Schumacker & Martigny (1995); infected by *Lamprospora campylopodis* W. D. Buckley *(Pezizales).*
++*Cephalozia bicuspidata* (L.) Dumort. – 12 *(8836);* siliceous rock.
Cephaloziella divaricata (Sm.) Schiffn. – 11 *(8762),* 12 *(8786),* 14 *(8885),* 18 *(8929),* 20 *(8950);* shaded siliceous rock, acidic soil.

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Ceratodon purpureus (Hedw.) Brid. – 8 *(8724),* 10 *(8752),* 12 *(8790),* 13 (obs.), 14 (obs.), 18 (obs.), 19 *(8943);* (disturbed) acidic soil.
Conocephalum conicum (L.) Dumort. – 17 *(8921),* 18 (obs.); rock and soil near water.
Corsinia coriandrina (Spreng.) Lindb. – 12 *(8828),* 14 *(8890),* 15 *(8897),* 20 *(8950),* 23 *(8994),* 25 *(9005);* soil; with *Oxymitra incrassata, Gongylanthus ericetorum, Riccia macrocarpa, R.* cf. *bifurca.* – Det. C. Sérgio.
Cynodontium bruntonii (Sm.) Bruch & Schimp. – 13 *(8855)* c. spg.; siliceous boulder.
Dicranella heteromalla (Hedw.) Schimp. – 18 *(8929);* soil.
Dicranella howei Renauld & Cardot – 4 *(8680),* 25 *(9002);* soil.
++*Dicranoweisia cirrata* (Hedw.) Lindb. ex Milde – 13 *(8882);* bark of *Pinus halepensis*.
Dicranum scoparium Hedw. – 10 *(8745),* 19 *(8942);* soil.
Didymodon acutus (Brid.) K. Saito – 9 *(8741);* base-rich siliceous rock.
Didymodon luridus Spreng. – 1 *(8672),* 4 *(8682),* 5 *(8693),* 6 *(8709);* calcareous soil.
+*Didymodon rigidulus* Hedw. – 10 *(8764);* calcareous soil.
Didymodon spadiceus (Mitt.) Limpr. – 17 *(8919);* horizontal fissures of base-rich siliceous rock near creek.
Didymodon tophaceus (Brid.) Lisa – 10 *(8771c)* c. spg., 19 *(8946)*.
Didymodon vinealis (Brid.) R. H. Zander var. *vinealis* – 2 *(8674),* 3 *(8677),* 4 *(8678, 8679),* 5 *(8685);* house wall, dry calcareous rock, disturbed soil.
Didymodon vinealis var. *flaccidus* (Bruch & Schimp.) R. H. Zander – 9 *(8735, 8738),* 10 *(8751),* 12 *(8792),* 16 *(8907),* 17 *(8920);* shaded base-rich rock, concrete, soil; with *Fissidens taxifolius, Grimmia lisae.*
Drepanocladus aduncus (Hedw.) Warnst. – 12 *(8834);* in water of creek.
+*Encalypta streptocarpa* Hedw. – 9 *(8742);* base-rich rock.
++*Entosthodon attenuatus* (Dicks.) Bryhn – 12 *(8820, 8822, 8831, 8837)* c. spg.; alluvium deposited on nearly vertical faces of small rocks in shallow stream; with *Cephalozia bicuspidata, Jungermannia hyalina.*
******Ephemerum serratum* (Hedw.) Hampe – 12 *(8824),* 20 *(8954);* moist sand; with *Polytrichum juniperinum, Fossombronia* sp., *Riccia macrocarpa, R. papillosa.* – Det. C. Sérgio *(8954)*.
Epipterygium tozeri (Grev.) Lindb. – 12 *(8842, 8843),* 13 *(8861, 8862),* 18 *(8931),* 22 *(8983),* 25 *(9004);* moist sandy soil; with *Fissidens taxifolius, Fossombronia* sp., *Scapania compacta*.
Eucladium verticillatum (Brid.) Bruch & Schimp. – 3 *(8675);* humid calcareous stones at well.
Eurhynchium crassinervium (Wilson) Schimp. – 10 *(8758, 8769);* base-rich rock.
Eurhynchium hians (Hedw.) Sande Lac. – 10 *(8754, 8757),* 12 *(8803, 8808),* 13 *(8877);* moist concrete, stone in flowing water, soil; with *Bryum pseudotriquetrum, Platyhypnidium riparioides.*
Eurhynchium praelongum (Hedw.) Schimp. – 12 *(8811),* 13 *(8861),* 22 *(8991);* on stones and soil near water of creeks.
++*Fabronia pusilla* Raddi – 22 *(8987);* vertical shaded rock; with *Leptodon smithii.*
Fissidens dubius P. Beauv. – 10 *(8758),* 18 *(8932),* 21 *(8971);* base-rich rock.
Fissidens taxifolius Hedw. – 10 *(8748, 8751, 8757, 8760),* 12 *(8792, 8809),* 13 *(8862),* 16 (obs.), 21 *(8967);* soil.
Fontinalis antipyretica Hedw. – 12 *(8818, 8819, 8830),* 13 *(8876),* 18 *(8935),* 22 *(8979);* stones in flowing water.
Fossombronia angulosa (Dicks.) Raddi – 4 *(8682),* 12 *(8793),* 14 *(8885),* 20 *(8950);* soil; with *Riccia* spp.
Frullania dilatata (L.) Dumort. – 6 *(8705)* c. spg., 10 *(8746),* 12 *(8817),* 16 (obs.), 19 (obs.), 22 (obs.); bark of *Quercus, Platanus orientalis*.
Frullania tamarisci (L.) Dumort. – 15 *(8896);* soil.
Funaria hygrometrica Hedw. – 5 *(8696),* 16 (obs.), 18 (obs.); soil.
+*Funaria muhlenbergii* Turner – 19 *(8944);* soil.

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Gongylanthus ericetorum (Raddi) Nees – 12 *(8827),* 13 *(8846, 8848, 8853),* 15 *(8897),* 20; soil; with *Scapania compacta, Lophozia bicrenata, Polytrichum piliferum, Oxymitra incrassata, Riccia* spp.

+*Grimmia decipiens* (Schultz) Lindb. – 8 *(8733),* 11 *(8773),* 13 *(8849)* c. spg.; siliceous rock. – Det. vel confirm. E. Maier.

Grimmia laevigata (Brid.) Brid. – 11 *(8774, 8777, 8780),* 12 *(8788),* 13 *(8850, 8859, 8881),* 19 *(8947),* 20 *(8952);* siliceous rock; with *Grimmia lisae, Hedwigia stellata*.

+*Grimmia lisae* De Not. – 8 *(8730, 8732),* 12 *(8798, 8799)* c. spg., 13 *(8850),* 17 *(8920),* 18 *(8933, 8936),* 20 *(8953),* 21 *(8957, 8965),* 22 *(8988);* siliceous rock; with *Hedwigia ciliata* var. *leucophaea, H. stellata, G. laevigata, Pterogonium gracile, Didymodon vinealis* var. *flaccidus*. – Det. vel confirm. E. Maier.

+*Grimmia meridionalis* (Müll. Hal.) E. Maier – 10 *(8762),* 12 *(8784, 8790);* siliceous rock; with *Polytrichum piliferum, Ceratodon purpureus*. – Det. vel confirm. E. Maier.

+*Grimmia montana* Bruch & Schimp. – 11 *(8778);* siliceous rock; with *G. laevigata, Hedwigia ciliata* var. *leucophaea*. – confirm. E. Maier.

Grimmia pulvinata (Hedw.) Sm. – 6 *(8699),* 8 *(8732),* 9 *(8734, 8737, 8738, 8739),* 10 *(8752),* 12 *(8787, 8791),* 16 (obs.), 18 (obs.); siliceous and base-rich rock, stones; with *Grimmia lisae, Hedwigia stellata; Schistidium apocarpum, Didymodon acutus*. – Confirm. E. Maier.

++*Grimmia tergestina* Bruch & Schimp. – 6 *(8716);* sun-exposed calcareous rock.

Grimmia trichophylla Grev. – 13 *(8873);* siliceous rock. – Confirm. E. Maier.

Gymnostomum calcareum Nees & Hornsch. – 10 *(8755);* with *Eucladium verticillatum.*

Gyroweisia tenuis (Hedw.) Schimp. – 1 *(8663),* 7 *(8723);* calcareous rock.

Habrodon perpusillus (De Not.) Lindb. – 6 *(8712),* 22 *(8985, 8986);* bark of *Quercus, Platanus orientalis.*

Hedwigia ciliata (Hedw.) P. Beauv. var. *ciliata* – 11 *(8772);* siliceous rock; with *Metzgeria furcata*.

**Hedwigia ciliata* var. *leucophaea* Bruch & Schimp. – 8 *(8727, 8729, 8731),* 11 *(8779, 8791);* siliceous rock; with *H. stellata, Grimmia lisae, G. laevigata, Leucodon sciuroides.*

++*Hedwigia stellata* Hedenäs – 8 *(8731, 8732),* 11 *(8782),* 12 *(8802),* 13 *(8845, 8854),* 19 *(8945);* siliceous rock; with *H. ciliata* var. *leucophaea, Grimmia lisae, Cynodontium* sp.

Homalothecium lutescens (Hedw.) H. Rob. – 9 *(8736),* 16 *(8908);* basic rock and soil.

Homalothecium sericeum (Hedw.) Schimp. – 6 *(8700, 8704),* 8 *(8730), 9 (8743),* 10, 16, 22; siliceous and base-rich rock, bark of *Quercus, Platanus orientalis;* with *Encalypta streptocarpa, Plagiochila porelloides.*

Hypnum cupressiforme Hedw. – 1 *(8664, 8665),* 6 *(8709),* 9 *(8743),* 10 *(8750),* 12 *(8835),* 13 *(8853),* 14 (obs.), 16 (obs.), 18 (obs.), 21 *(8965),* 22 (obs.); soil, rock, trees.

Isothecium alopecuroides (Dubois) Isov. – 17 *(8927); Carpinus* root.

Isothecium myosuroides Brid. – 21 *(8966, 8968);* siliceous rock.

++*Jungermannia hyalina* Lyell – 12 *(8820, 8832);* earth-filled crack of small boulder, periodically submerged; with *Entosthodon attenuatus*.

++*Leiocolea badensis* (Gottsche) Jörg. – 21 *(8964)* c. per.; siliceous rock.

Lejeunea cavifolia (Ehrh.) Lindb. – 17 *(8913, 8915),* 18 *(8931),* 21 *(8972),* 22 *(8982, 8984);* rock and tree trunks; with *Radula complanata, Fissidens dubius, Scorpiurium deflexifolium, Reboulia hemisphaerica.*

Leptodon smithii (Hedw.) Mohr – 17 *(8926),* 21 *(8962)* c. spg., 22 *(8987); Fagus* trunk, rock; with *Fabronia pusilla, Radula complanata.*

Leucodon sciuroides (Hedw.) Schwägr. – 6 *(8701, 8703),* 8 *(8727),* 16 *(8909, 8910); Fagus* and *Quercus* trunks, siliceous rock outcrops; with *Pterogonium gracile, Hedwigia ciliata* var. *leucophaea.*

+*Lophocolea bidentata* (L.) Dumort. – 13 *(8868)* c. per., 19 *(8942);* soil; with *Rhizomnium punctatum, Scleropodium touretii, Polytrichum juniperinum, Dicranum scoparium, Hypnum cupressiforme.*

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Lophocolea heterophylla (Schrad.) Dumort. – 10 *(8750n),* 12 *(8841),* 13 *(8870)* c. per., 18 *(8932), 21 (8961);* soil, rotten wood; with *Calypogeia fissa, Bartramia pomiformis*.

+*Lophocolea minor* Nees – 13 *(8861);* soil; with *Calypogeia fissa, Epipterygium tozeri, Eurhynchium praelongum.*

**Lophozia bicrenata* (Hoffm.) Dumort. – 13 *(8847)* c. per.; acidic soil; with *Campylopus oerstedianus*.

Lunularia cruciata (L.) Lindb. – 12 *(8806),* 18 (obs.), 22 (obs.); rock and moist soil; with *Entosthodon attenuatus*.

++*Marchantia paleacea* Bertol. – 10 *(8766);* soil. – Listed by Schumacker & Martigny (1995) as insufficiently known; confirm. J. Váňa.

Metzgeria furcata (L.) Dumort. – 11 *(8772);* siliceous rock; with *Hedwigia ciliata* var. *ciliata*.

Neckera complanata (Hedw.) Huebener – 17 *(8916);* tree root.

Orthotrichum affine Brid. – 6 *(8697, 8702),* 10 *(8746),* 12 *(8804, 8844),* 16 *(8909);* bark of *Quercus, Alnus, Platanus orientalis;* with *O. diaphanum, O. striatum, Radula complanata, Frullania dilatata.*

Orthotrichum anomalum Hedw. – 6 *(8717),* 10 *(8754);* limestone rock, concrete.

Orthotrichum cupulatum Brid. var. *cupulatum* – 9 *(8740),* 10 *(8765, 8768),* all c. spg.; base-rich rock.

Orthotrichum diaphanum Brid. – 6 *(8697, 8698); Quercus* bark; with *O. affine, O. pallens.*

Orthotrichum lyellii Hook. & Taylor – 6 *(8702),* 16; *Quercus* bark; with *Frullania dilatata, O. affine*.

++*Orthotrichum pallens* Brid. – 6 *(8698)* c. spg.; *Quercus bark;* with *O. diaphanum*.

Orthotrichum pumilum Sw. – 6 *(8705),* c. spg.; *Quercus* bark; with *Frullania dilatata.*

Orthotrichum rupestre Schwägr. – 8 *(8725),* 11 *(8783),* 12 *(8812),* all c. spg.; siliceous rock; with *Leudodon sciuroides.*

Orthotrichum striatum Hedw. – 10 *(8746),* 12 *(8844); Quercus* and *Alnus* bark; with *O. affine, Radula complanata, Frullania dilatata.*

Orthotrichum tenellum Brid. – 12 *(8817)* c. spg.; *Platanus orientalis* trunk; with *Frullania dilatata*.

+*Oxymitra incrassata* (Brot.) Sérgio & Sim-Sim – 14 *(8886, 8890, 8891),* 15 *(8897, 8898, 8900, 8903),* 20 (obs.), 23 *(8994);* soil between siliceous boulders; with *Riccia* spp., *Gongylanthus ericetorum.*

Pellia endiviifolia (Dicks.) Dumort. – 10 *(8759),* 17 *(8922)* c. per.; moist soil and rock; with *Pohlia melanodon*.

Phaeoceros cf. *laevis* (L.) Prosk. – 12 *(8807, 8813),* 19 *(8943),* 22 *(8991),* 25 *(8999, 9000, 9001),* all sterile or young thalli with antheridia; moist soil; with *Eurhynchium praelongum, Scleropodium touretii, Epipterygium tozeri; Fossombronia* sp.

Phascum cuspidatum Hedw. – 6 *(8699);* soil.

+*Philonotis caespitosa* Jur. – 12 *(8794, 8797),* 17 *(8924),* 22 *(8976),* 25 *(9002);* moist soil; with *Bryum pseudotriquetrum, Cephalozia bicuspidata, Reboulia hemisphaerica, Scleropodium touretii, Plagiochila porelloides, Riccia* spp.; *Scapania compacta, Dicranella howei, Barbula unguiculata.*

Plagiochila porelloides (Nees) Lindenb. – 9 *(8743),* 10 *(8770),* 17 *(8914, 8923);* rock; with *Homalothecium sericeum, Encalypta streptocarpa, Campylium calcareum*.

Plagiomnium affine (Blandow) T. J. Kop. – 13 *(8869);* rotting wood; with *Plagiothecium nemorale*.

Plagiomnium undulatum (Hedw.) T. J. Kop. – 13 *(8866);* soil.

Plagiothecium nemorale (Mitt.) A. Jaeger – 13 *(8869);* rotting wood; with *Plagiomnium affine*.

Platyhypnidium riparioides (Hedw.) Dixon – 3 *(8675),* 13 *(8875, 8877, 8878),* 17 (obs.), 22 *(8978, 8981)* c. spg., 25 *(8998);* stones in standing or flowing water; with *Fontinalis antipyretica, Scorpiurium deflexifolium.*

++*Pleuridium subulatum* (Hedw.) Rabenh. – 10 *(8761);* soil.

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Pleurochaete squarrosa (Brid.) Lindb. – 1 *(8667, 8669, 8670),* 5 *(8696), 6 (8707),* 10 *(8753),* 12 *(8785),* 14 *(8883);* base-rich soil; with *Barbula unguiculata, Scleropodium touretii, Tortula ruralis.*

Pogonatum aloides (Hedw.) P. Beauv. – 12 *(8843)* c. spg., 13 *(8871),* 19 (obs.); moist soil; with *Epipterygium tozeri, Fissidens taxifolius, Scapania compacta*.

**Pohlia annotina* (Hedw.) Lindb. – 12 *(8840);* moist sand; with *Polytrichum juniperinum*.

+*Pohlia melanodon* (Brid.) A. J. Shaw – 10 *(8755),* 17 *(8922);* soil; with *Pellia endiviifolia.*

Pohlia wahlenbergii (F. Weber & D. Mohr) A. L. Andrews – 17 *(8912);* soil.

Polytrichum formosum Hedw. – 10 *(8745);* soil; with *Dicranum scoparium.*

Polytrichum juniperinum Hedw. – 12 *(8824, 8840),* 15 *(8904),* 18 (obs.), 19 *(8942),* 20 (obs.); soil.

Polytrichum piliferum Hedw. – 11 (obs.), 12 *(8784),* 13 *(8848);* acidic soil; with *Grimmia meridionalis, Gongylanthus ericetorum.*

+*Pseudocrossidium revolutum* (Brid.) R. H. Zander – 10 *(8762);* basic soil; with *Didymodon rigidulus.*

Pterogonium gracile (Hedw.) Sm. – 8 *(8727, 8728),* 21 *(8960),* 22 *(8993)* c. spg.; shaded siliceous rock; with *Hedwigia ciliata* var. *leucophaea, Leucodon sciuroides, Grimmia lisae, Scleropodium touretii*.

Racomitrium aciculare (Hedw.) Brid. – 17 *(8923)* c. spg.; moist siliceous rock.

Racomitrium canescens (Hedw.) Brid. – 11 *(8775),* 19 *(8939);* siliceous rock, soil.

Radula complanata (L.) Dumort. – 6 *(8706),* 7 *(8722)* c. spg., 10 *(8746),* 16 *(8907)* c. per., 18 *(8931),* 21 *(8963),* 22 *(8987);* bark of *Quercus* and other trees, rock; with *Orthotrichum affine, O. striatum, Frullania dilatata, Leptodon smithii, Fabronia pusilla.*

Reboulia hemisphaerica (L.) Raddi – 12 *(8786),* 13 *(8872, 8874),* 14 *(8895),* 17 *(8924),* 19 *(8944),* 22 *(8990);* soil; with *Atrichum angustatum, Bartramia pomiformis, Lejeunea cavifolia, Scleropodium touretii, Plagiochila porelloides, Philonotis caespitosa.*

Rhizomnium punctatum (Hedw.) T. J. Kop. – 13 *(8868);* soil.

Rhynchostegiella tenella (Dicks.) Limpr. – 1 *(8671)* c. spg.; stone wall remnants.

Rhynchostegiella teneriffae (Mont.) Dirkse & Bouman – 12 *(8810, 8813);* moist siliceous rock; with *Thamnobryum alopecurum, Phaeoceros* cf. *laevis, Riccardia chamedryfolia.*

Rhynchostegium confertum (Dicks.) Schimp. – 13 *(8867)* c. spg., 17 *(8925);* moist siliceous rock; with *Brachythecium populeum*.

Rhynchostegium megapolitanum (F. Weber & D. Mohr) Schimp. – 5 *(8686, 8689),* 13 *(8865);* soil; with *Scleropodium touretii.*

++*Riccardia chamedryfolia* (With.) Grolle – 12 *(8796, 8813);* moist shaded soil; with *Phaeoceros* cf. *laevis.*

***Riccia beyrichiana* Lehm. – 12 *(8833), 22 (8977);* moist sand. – Det. C. Sérgio.

**Riccia* cf. *bifurca* Hoffm. – 20 *(8950);* soil; with *R. macrocarpa, Corsinia coriandrina*. – Det. C. Sérgio.

**Riccia canaliculata* Hoffm. – 20 *(8955);* moist soil. – Confirm. C. Sérgio.

++*Riccia ciliifera* Lindenb. – 14 *(8893, 8894),* 15 *(8902, 8906),* 20 *(8951);* soil; with *R. nigrella, R. macrocarpa, R. papillosa, Oxymitra incrassata*. – Det. C. Sérgio.

++*Riccia crinita* Taylor – 14 *(8888, 8889),* 15 *(8898),* 20 *(8956);* soil; with *R. nigrella, R. papillosa, R. macrocarpa, Oxymitra incrassata*. – Confirm. C. Sérgio.

++*Riccia* cf. *crozalsii* Levier – 12 *(8823);* moist sand; with *Fossombronia* sp. – Det. C. Sérgio.

Riccia crystallina L. emend. Raddi – 12 *(8786, 8801, 8824, 8826),* 14 *(8885);* moist sandy soil. – Confirm. C. Sérgio.

++*Riccia macrocarpa* Levier – 12 *(8825, 8829),* 15 *(8898, 8899, 8902),* 20 *(8950, 8954),* 23 *(8996);* soil; with *R. crinita, R. nigrella, R. papillosa, Oxymitra incrassata, R.* cf. *bifurca, Corsinia coriandrina*. – Det. vel confirm. C. Sérgio.

++*Riccia nigrella* DC. – 14 *(8887, 8892),* 15 *(8898, 8899, 8903, 8905),* 23 *(8996);* soil; with *R. ciliifera, R. crinita, R. papillosa, R. macrocarpa, Oxymitra incrassata.* – Confirm. C. Sérgio.

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++*Riccia papillosa* Moris – 15 *(8898, 8899, 8902),* 20 *(8954);* soil; with *R. crinita, R. nigrella, R. macrocarpa, Oxymitra incrassata, Ephemerum serratum.* – Confirm. C. Sérgio.

Riccia sorocarpa Bisch. – 14 *(8884);* soil. – Confirm. C. Sérgio.

Scapania compacta (Roth) Dumort. – 13 *(8871, 8880)* c. spg., 15 *(8904),* 25 *(9004, 9006)* c. per.; soil and rock; with *Gongylanthus ericetorum, Pogonatum aloides.*

Scapania undulata (L.) Dumort. – 13 *(8864);* moist soil; with *Bryum pseudotriquetrum.*

Schistidium apocarpum (Hedw.) Bruch & Schimp. – 9 *(8737)* c. spg.; rock; with *Grimmia pulvinata.*

Schistidium crassipilum H. H. Blom – 10 *(8756)* c. spg.; siliceous rock.

Scleropodium purum (Hedw.) Limpr. – 18 *(8932),* 19 *(8940);* soil.

Scleropodium touretii (Brid.) L. F. Koch – 1 *(8665, 8668, 8669),* 5 *(8688, 8690, 8692, 8695, 8696),* 7 *(8721),* 10 *(8749),* 12 *(8789),* 17 *(8924),* 18 *(8938),* 19 *(8942),* 21 *(8973),* 25 *(9000, 9003);* soil; with *Pleurochaete squarrosa, Rhynchostegium megapolitanum, Campylium calcareum, Reboulia hemisphaerica, Plagiochila porelloides, Philonotis caespitosa, Fossombronia* sp., *Lophocolea bidentata.*

Scorpiurium circinatum (Brid.) M. Fleisch. & Loeske – 1 *(8668),* 12 *(8816);* soil, tree root; with *Thamnobryum alopecurum.*

Scorpiurium deflexifolium (Solms) M. Fleisch. & Loeske – 18 *(8934, 8937),* 19 *(8948, 8949),* 21 *(8958),* 22 *(8975, 8980, 8992);* stones in flowing water, often at small flushes; with *Platyhypnidium riparioides, Lejeunea cavifolia.*

Thamnobryum alopecurum (Hedw.) Gangulee – 12 *(8816),* 17 (obs.), 18 (obs.); tree roots, moist rock; with *Scorpiurium circinatum.*

***Thuidium delicatulum* (Hedw.) Schimp. – 10 *(8744);* moist shaded soil in *Pinus* forest.

Tortella flavovirens (Bruch) Broth. var. *flavovirens* – 1 *(8665),* 4 *(8683)* c. spg., 24 *(8997);* basic soil; with *Scleropodium touretii, Hypnum cupressiforme.*

++*Tortella humilis* (Hedw.) Jenn. – 1 *(8664)* c. set., basic soil; with *Bryum capillare, Hypnum cupressiforme.*

Tortella tortuosa (Hedw.) Limpr. – 10 *(8748);* base-rich rock.

++*Tortula canescens* Mont. – 23 *(8995);* nearly vertical face of sun-exposed rock; with *Selaginella denticulata, Oxymitra incrassata, Riccia nigrella.*

+*Tortula crinita* (De Not.) De Not. – 6 *(8715);* insolated calcareous rock.

Tortula muralis Hedw. – 1 *(8666, 8670, 8673),* 2 *(8674),* 3 *(8677),* 10 (obs.), 12 (obs.); stones, wall, concrete, rock; with *Rhynchostegiella tenella, Didymodon luridus, Pleurochaete squarrosa, Didymodon vinealis* var. *vinealis.*

Tortula ruralis (Hedw.) P. Gaertn., B. Mey. & Scherb. – 6 *(8707),* 11 *(8776);* soil and soil-covered siliceous rock; with *Pleurochaete squarrosa, Racomitrium canescens.*

Tortula subulata Hedw. var. *subulata* – 13 *(8856),* 16 *(8908),* 19 *(8942);* soil; siliceous boulders; with *Hedwigia stellata.*

Tortula subulata var. *angustata* (Schimp.) Limpr. – 10 *(8748);* soil; with *Fissidens taxifolius.*

++*Tortula subulata* var. *subinermis* (Bruch & Schimp.) Wilson – 8 *(8724)* c. spg.; soil.

+*Tortula virescens* (De Not.) De Not. – 6 *(8718);* bark of *Quercus.*

Trichostomum brachydontium Bruch – 12 *(8832),* 17 *(8918),* 18 *(8930),* 21 *(8959);* rock.

Trichostomum crispulum Bruch – 1 *(8863),* 5 *(8694)* c. spg., 10 *(8767),* 17 *(8911),* 22 *(8991);* soil, rock.

Weissia brachycarpa (Nees & Hornsch.) Jur. – 6 *(8711)* c. spg.; soil.

++*Weissia controversa* Hedw. s. str. *(W. controversa* var. *controversa)* – 8 *(8726)* c. spg.; soil.

***Weissia* cf. *longifolia* Mitt. – 10 *(8761)* c. spg. (juvenile); soil.

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